Title: Off-Site Source Recovery Program

Author(s): Coel-Roback, Rebecca J.

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# Introduction to Nuclear Nonproliferation at Los Alamos

Los Alamos NATIONAL LABORATORY EST. 1943

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NNSA National Nuclear Security Administration

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# Off-Site Source Recovery Program


**Becky Coel-Robeck**
Program Manager, OSRP
International Threat Reduction
NEN-3

# Introduction

- Radioactive sealed sources have been in general use for more than 100 years.
- Sealed sources are used in medicine, research, agriculture, construction, oil and gas exploration…every day.
- Not all sources owned by licensees have a commercial disposal pathway.
- For over 20 years the OSRP mission has been to remove those unwanted radioactive sealed sources that pose a potential risk to national security, public health and safety.

**OSRP does not recover powders, liquids, or loose/diffuse radioactive material. The program is limited to discrete sealed sources with rad material in solid form.**

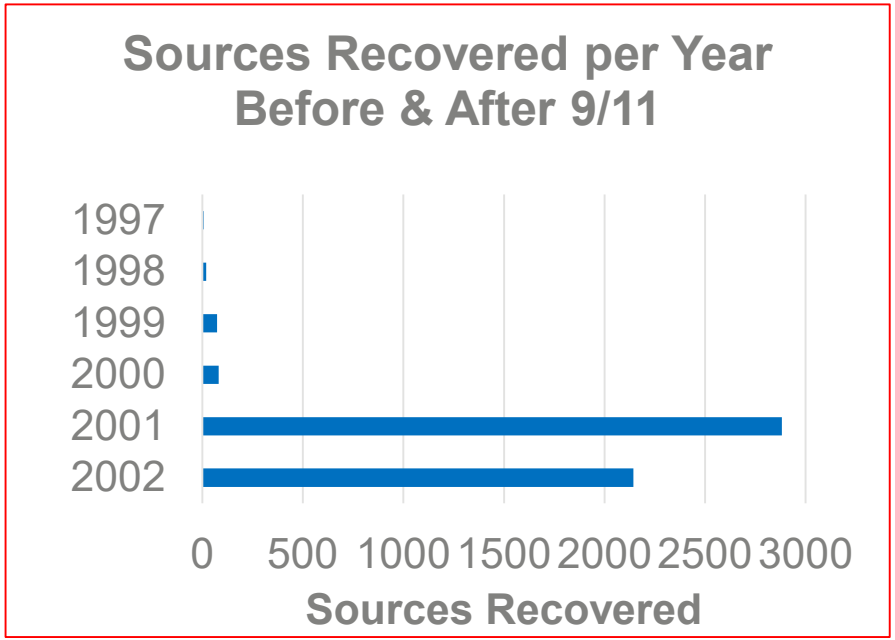
# Origin of OSRP

- **Pre-1994:** Need for end-of-life source management was identified and the Radioactive Source Recovery Program (RSRP) was conceived in 1994
- **1997:** RSRP pilot recovery operation demonstrated that such work can be done in a safe, effective, compliant, and cost-effective way.
- DOE introduced the “Off-site Source Recovery Project” (OSRP) in a memo to the LANL Director on **November 15, 1998**.

**OSRP has been recovering disused sealed radioactive sources for over two decades!**

# The Influence of 9/11

- In the four-year period from Sept. 1997 to Sept. 2001, OSRP removed a total of just 1,599 sources.
- In the one-year period from Sept. 11, 2001 to Sept. 11, 2002, OSRP successfully removed 2,667 radioactive sealed sources.
- 9/11 triggered a 500% increase in annual source recoveries.
- Since 2001, OSRP has continued to recover an average of about 2,100 disused sources each year.



# Programmatic Summary

- OSRP is sponsored by the NNSA Office of Radiological Security.
- OSRP provides assistance to many organizations.
- The OSRP team is made up of a dozen full-time experts in source recovery, source identification, packaging and transportation, health physics, radiation protection, and disposal.
- We maintain the only capability for disposal of sealed radioactive TRU sources at WIPP.




**OSRP collaborates with other National Laboratories and commercial vendors for high-activity removals, Type B container operations, and waste certification.**

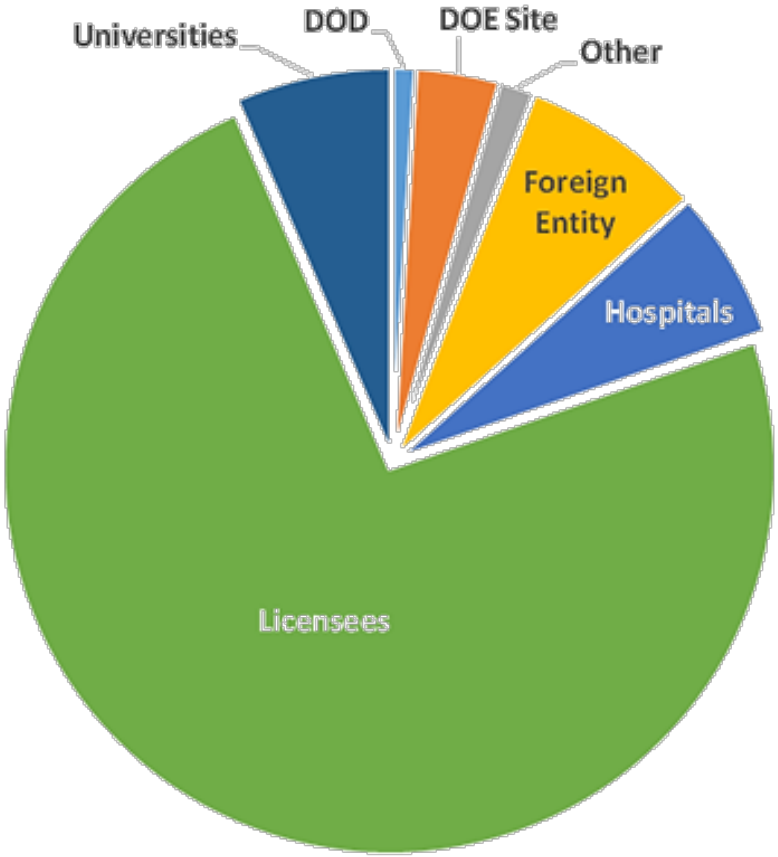
# OSRP Recovery Summary

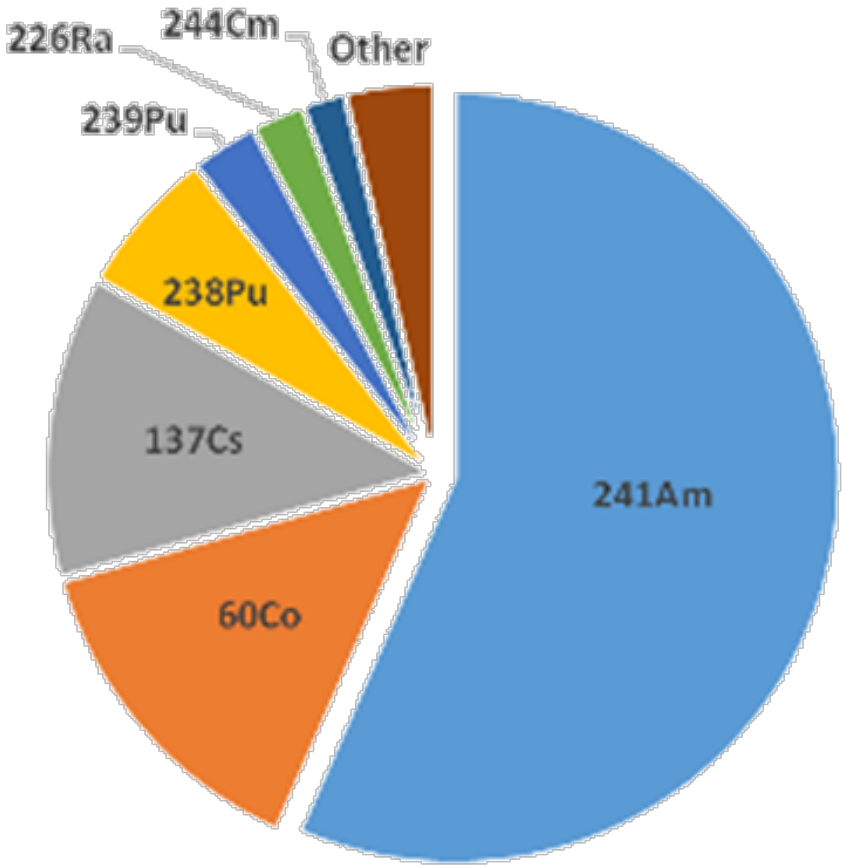
- To date, OSRP has contributed to national and global security by removing more than 42,000 radioactive sources, totaling over 1.3 million Curies of material.
- OSRP has removed sources from all 50 states and 27 countries worldwide.

| Isotope | Sources Recovered | Curies Recovered* |
|---|---|---|
| $^{60}$Co | 6,540 | 339,106 |
| $^{90}$Sr | 303 | 640,567 |
| $^{137}$Cs | 5,358 | 296,917 |
| $^{238}$Pu | 2,518 | 15,823 |
| $^{239}$Pu | 1,171 | 1,310 |
| $^{241}$Am | 23,767 | 17,352 |
| All Others | 2,919 | 387 |
| **TOTALS** | **42,576** | **1,311,463** |

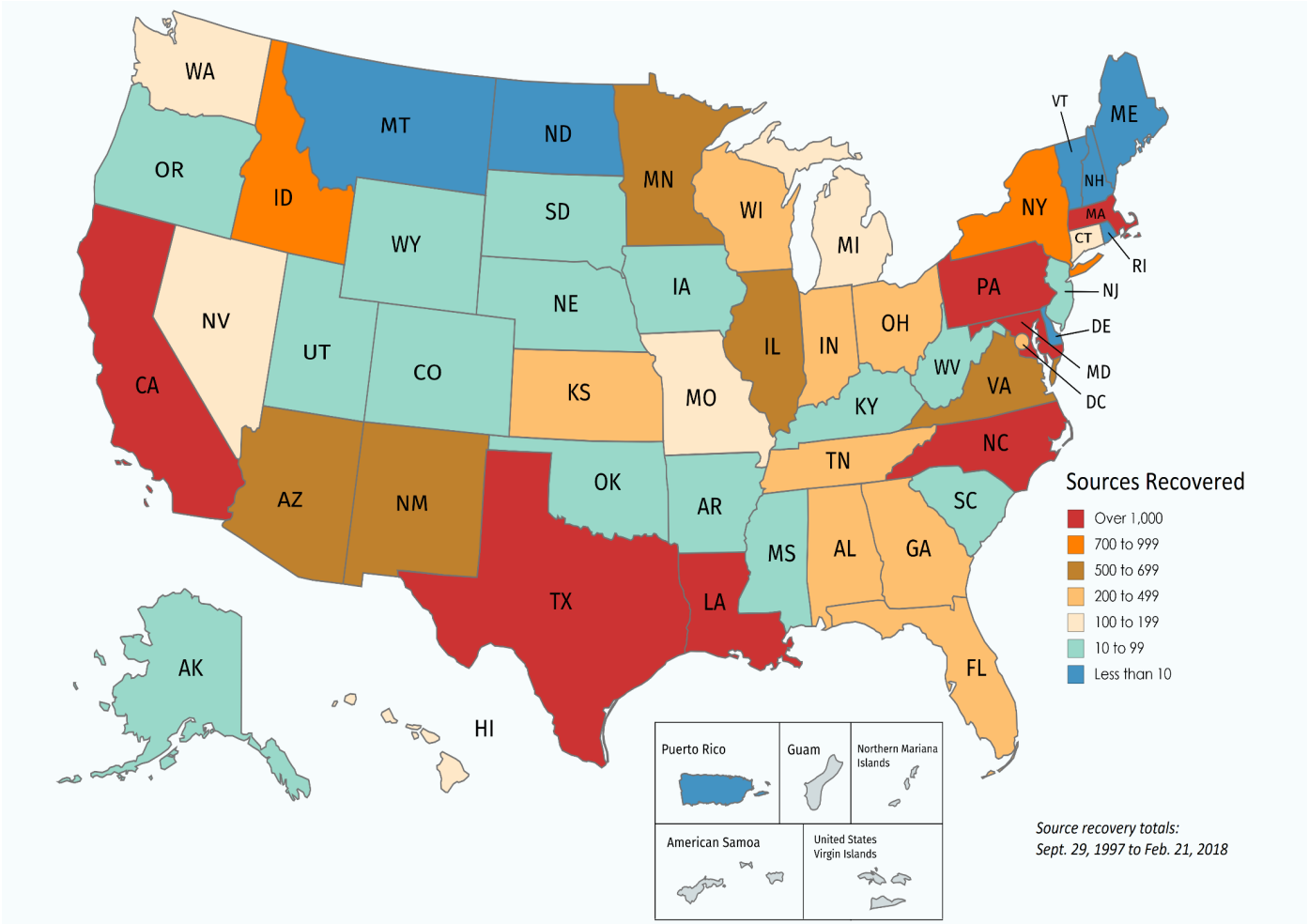
**OSRP Mission:** Over two decades of recovering excess, unwanted, abandoned, and orphaned radioactive sealed sources in the interest of national security and public health/safety.

# Facility and Isotope Types

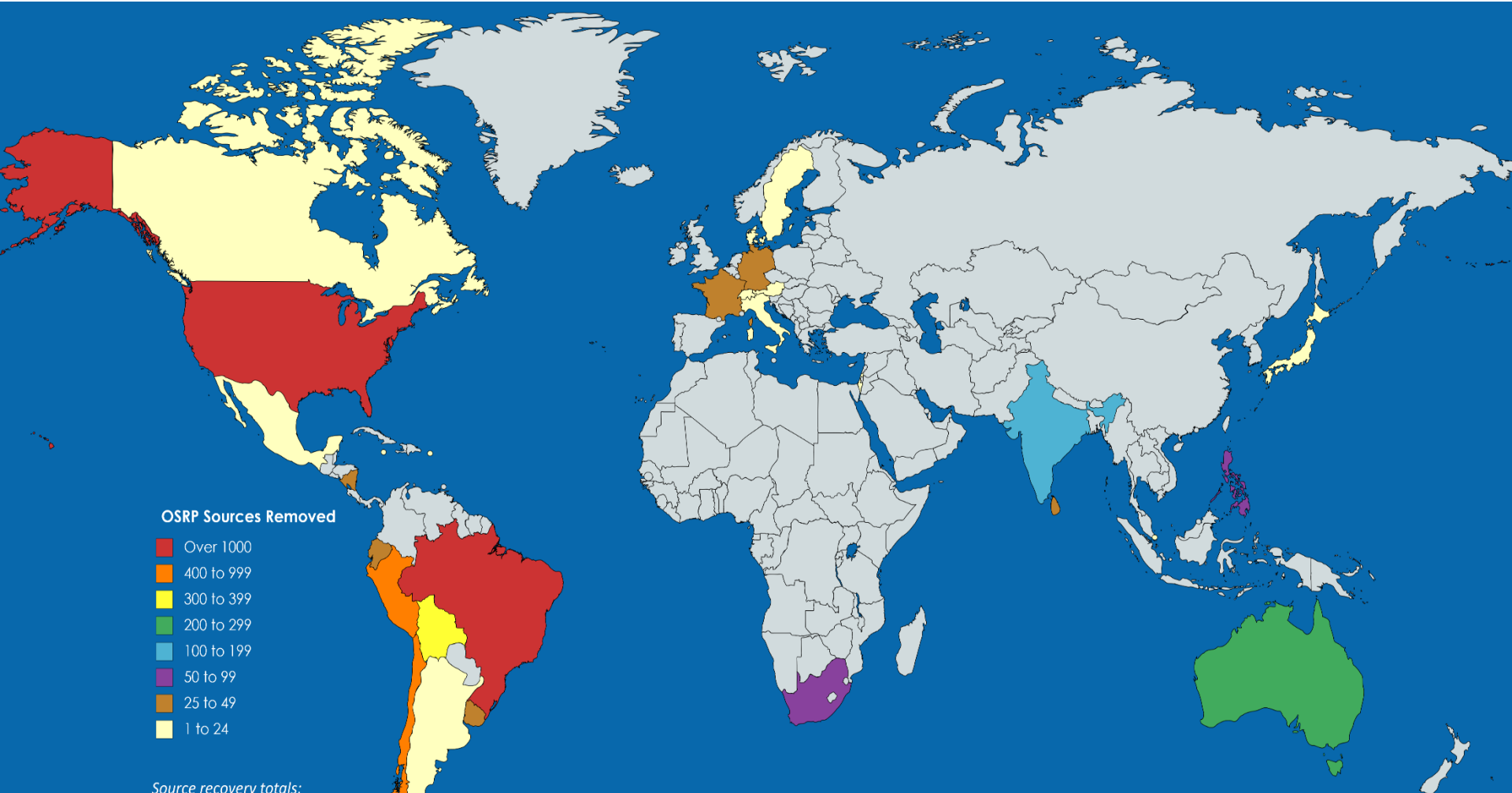


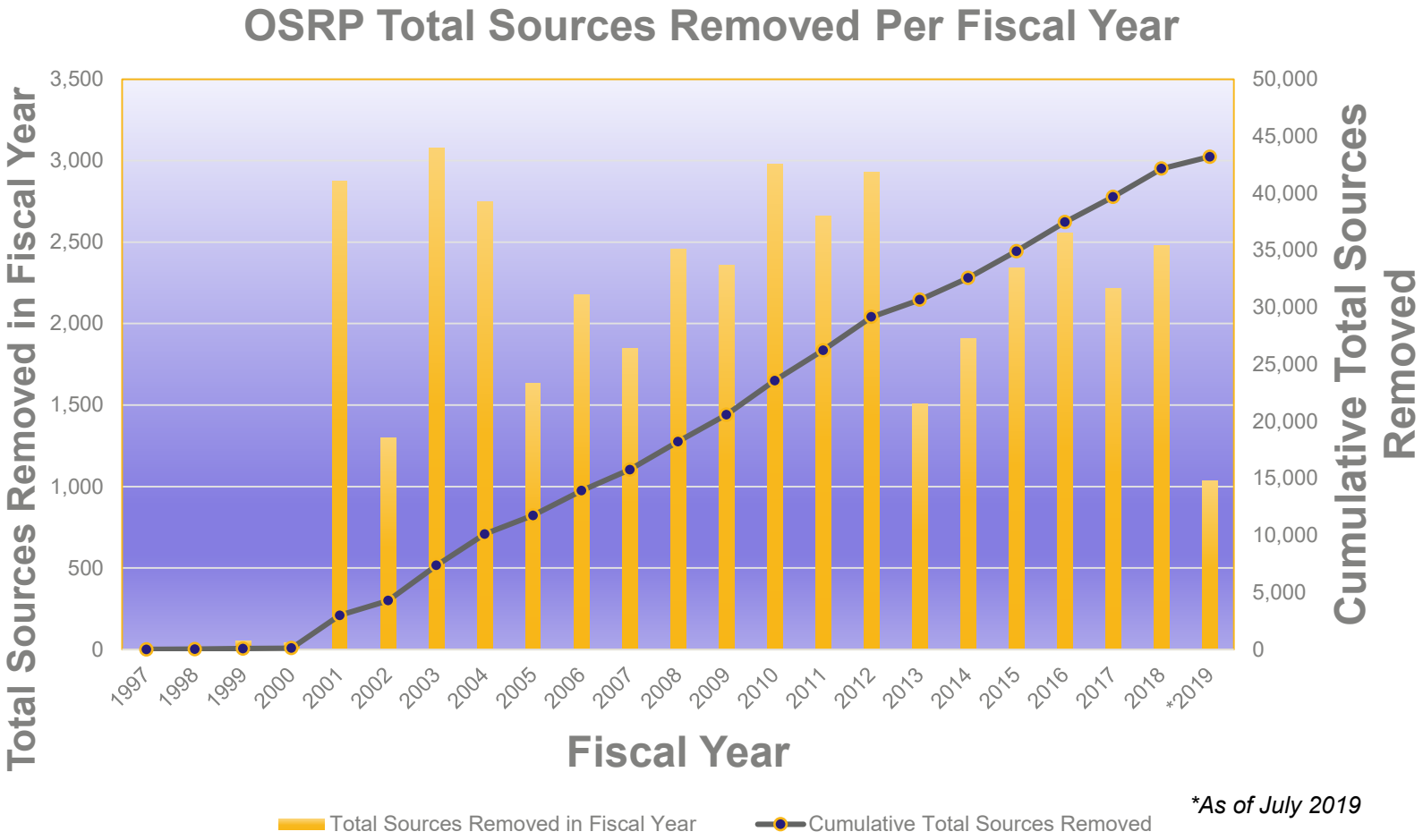
# US Domestic Recoveries



# Recoveries Worldwide



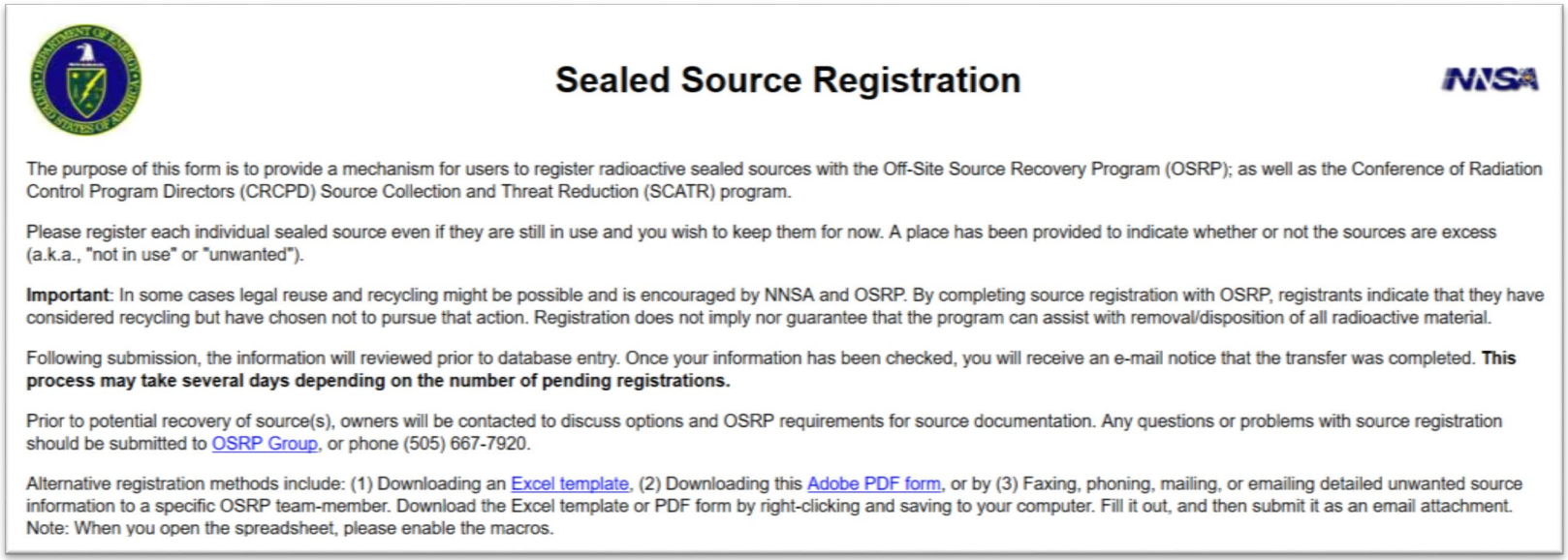
# Recoveries Over the Years




*As of July 2019

# Website and Database

- OSRP maintains tools to help identify and track disused sealed sources potentially eligible for recovery.
  - Public website that encourages registration of unwanted sources *https://osrp.lanl.gov/PickUpSources.aspx*
  - Internal database to allow prioritization of removal activities based on risk and plan removals to maximize efficiency



## Sealed Source Registration

NNSA

The purpose of this form is to provide a mechanism for users to register radioactive sealed sources with the Off-Site Source Recovery Program (OSRP); as well as the Conference of Radiation Control Program Directors (CRCPD) Source Collection and Threat Reduction (SCATR) program.

Please register each individual sealed source even if they are still in use and you wish to keep them for now. A place has been provided to indicate whether or not the sources are excess (a.k.a., "not in use" or "unwanted").

**Important**: In some cases legal reuse and recycling might be possible and is encouraged by NNSA and OSRP. By completing source registration with OSRP, registrants indicate that they have considered recycling but have chosen not to pursue that action. Registration does not imply nor guarantee that the program can assist with removal/disposition of all radioactive material.

Following submission, the information will reviewed prior to database entry. Once your information has been checked, you will receive an e-mail notice that the transfer was completed. **This process may take several days depending on the number of pending registrations.**

Prior to potential recovery of source(s), owners will be contacted to discuss options and OSRP requirements for source documentation. Any questions or problems with source registration should be submitted to OSRP Group, or phone (505) 667-7920.

Alternative registration methods include: (1) Downloading an Excel template, (2) Downloading this Adobe PDF form, or by (3) Faxing, phoning, mailing, or emailing detailed unwanted source information to a specific OSRP team-member. Download the Excel template or PDF form by right-clicking and saving to your computer. Fill it out, and then submit it as an email attachment. Note: When you open the spreadsheet, please enable the macros.

# Basic Planning Requirements

- Source information – isotope/activity/photos/swipe tests
- Location – domestic/international, facility size
- Desired packaging configuration and staging location
- Number of personnel needed
- Logistics and timing
  - Tools
  - Equipment
  - Drums/Packaging
  - Site availability
  - Travel arrangements

**The team does not operate as an emergency response source pick-up program; work is conducted off-site with extensive pre-planning.**

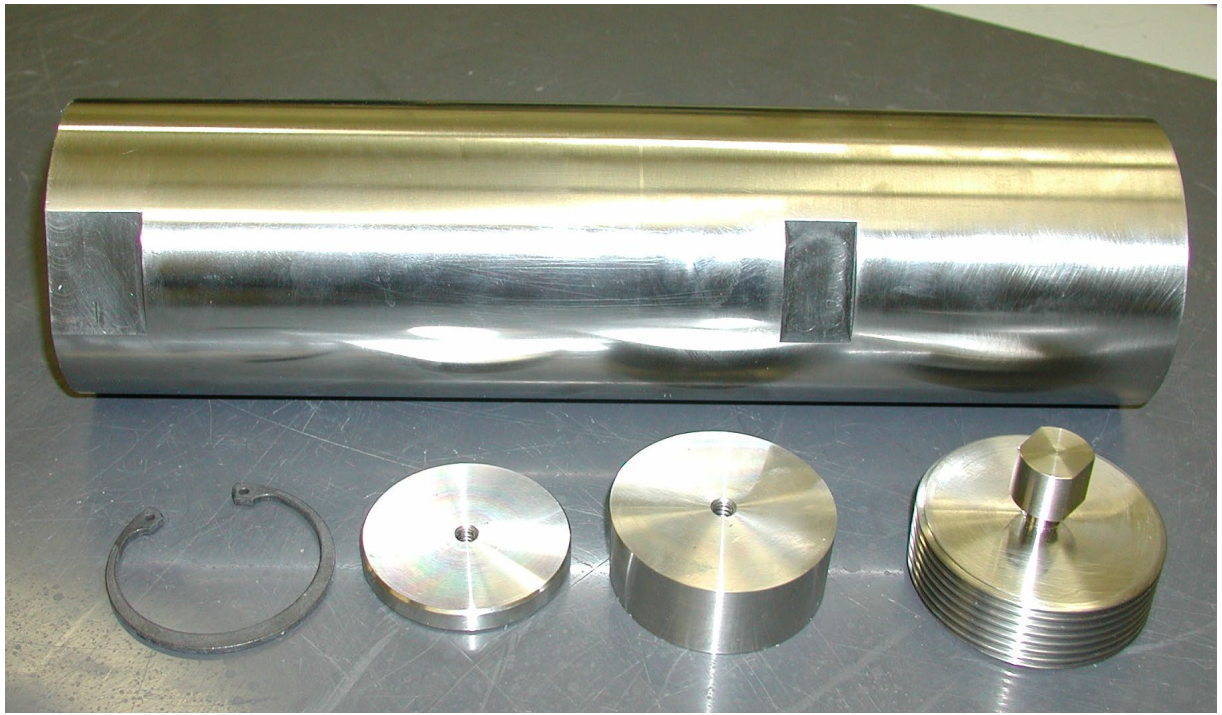
# Source Recovery Operations

- Beyond LANL and the DOE/NNSA complex, sealed radioactive sources are used by many different licensees.
- The team works with NRC and Agreement State licensed facilities such as private companies, universities, hospitals, and other governmental sites.
- For international recovery missions, the team works with foreign source owners and directly with their in-country regulators as well. We also coordinate with the IAEA.

# Source Recovery Operations

- OSRP staff travel the US and the world to successfully complete their mission.
- Off-site activities have been successfully completed at nuclear power plants, DOE and NNSA facilities, military bases, naval yards, commercial and industrial locations, and several foreign entities.
- Each location is different, so recoveries are individually structured to implement controls commensurate with the nature of the radiological packaging activities performed–in collaboration with the sources owner/licensee.

# Special Form Encapsulation



OSRP performs special form encapsulation for sealed sources to simplify transportation

# TRU Source Packaging, Storage, and Disposal

- Packages sealed sources in accordance with DOT/NRC regulations
- Packages material according to WIPP waste acceptance criteria for loading into TRUPACT-II containers and transport to WIPP
- Consolidates and arranges interim storage of sealed sources until permanent disposal


# High-Activity (Category 1 and 2) Beta-Gamma Recoveries

## Domestic Recoveries

- Prioritized based on current activity and level of security.
- Primarily blood and research irradiators, some teletherapy
- From medical institutions, universities, and various industries.
- Typically 10 to 20 device removals per year


## Cesium Irradiator Replacement Project (CIRP)

- Prioritized based on X-Ray replacement agreement with NNSA
- Primarily blood and research irradiators, some teletherapy
- From medical institutions, universities, and various industries.
- Demand has increased from 2 to 70 device removals per year.

# High-Activity (Category 1 and 2) Devices Commonly Recovered by OSRP

## Blood and Research Self-Shielded Irradiators

- Primarily Cs-137 and Co-60
- Typically 4.81TBq (130Ci) to 148TBq (4,000Ci) decayed

**Devices**

Gammacell 1000

Isotope: Cs137

Max Activity: 3,246Ci

Weight: 3,000 lbs

Gammacell 3000

Isotope: Cs137

Max Activity: 3,246Ci

Weight: 3,500 lbs

IBL 437C

Isotope: Cs137

Max Activity: 5,610Ci

Weight: 4,450 lbs

Gammacell 40

Isotope: Cs137

Max Activity: 4,200Ci

Weight: 7,000 lbs

Gammacell 220

Isotope: Cs137

Max Activity: 26,400Ci

Weight: 8,250 lbs

J.L Shepherd 143

Isotope: Cs137

Max Activity: 3,300Ci

Weight: 2,000 lbs

J.L Shepherd Mark 1

Isotope: Cs137

Max Activity: 22,500Ci

Weight: 3,000 lbs

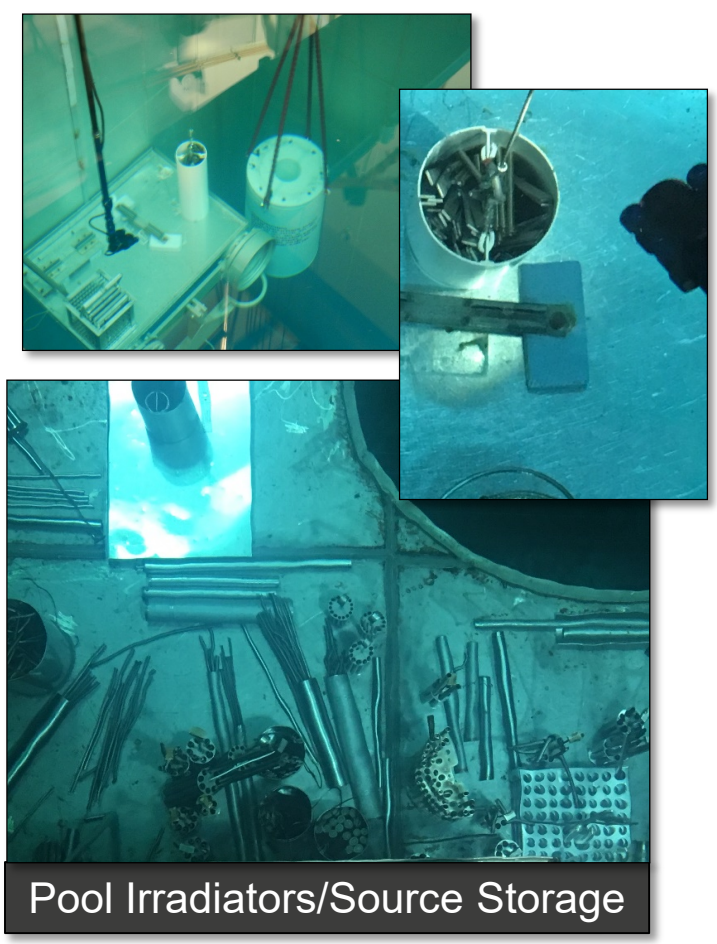
Theratron 780

Isotope: Co60

Max Activity: 13,400Ci

Weight: 5,500 lbs

# Other, Less Common, Removals



Pool Irradiators/Source Storage

Gamma Knife

# High-Activity Removal Operations

## Commercial Vendor Responsible for Transportation

- Commercial vendor removes device from licensee facility and prepares it for shipment.
- Commercial vendor is a registered user of a commercially available U.S. NRC-certified Type B container.
- Commercial vendor acts as shipper of record and is responsible for transportation security.
- Ownership transferred upon receipt at consolidation facility.

Nordion F-431
USA/9310/B(U)-96

NPI-20WC-6 MkII
USA/9215/B(U)-96

## DOE National Laboratory Responsible for Transportation

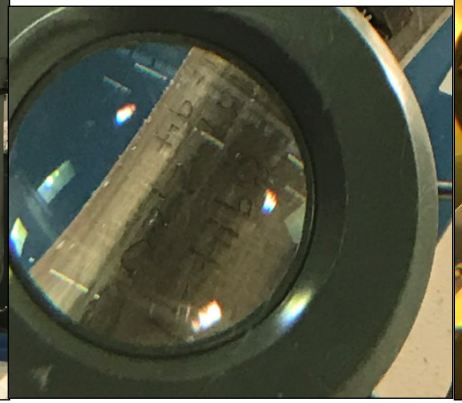
- Commercial vendor removes device from licensee facility and prepares it for shipment.
- DOE-owned and operated Type B container used for shipment.
- DOE/Lab acts as shipper of record and is responsible for transportation security.
- DOE-ownership is taken prior to the shipment.

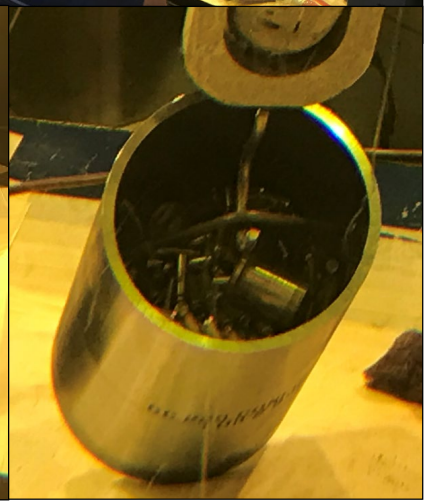
435-B
USA/9355/B(U)-96

CNS 10-160B
USA/9204/B(U)F-96

# Consolidation for Disposal

- Devices are disassembled and sources removed
- Source Serial Numbers are verified
- Sources are packaged in approved disposal configurations according to the Waste Acceptance Criteria of the disposal site.

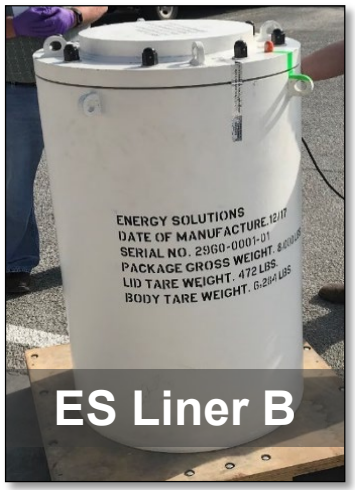




# Disposal Packaging

## Current Disposal Containers

- **Energy*Solutions* Disposal Liner A and B**
  - 7” lead shielding
  - Authorized Content in the 10-160B
  - 999TBq (27kCi) Cs137 / 352TBq (9.5kCi) Co60
  - Wet- or dry-load capability
  - Large physical payload space
- **GammaCell 200 and 220 Shields**
  - Repurposed shields from blood/research irradiators originally loaded up to 851TBq (23kCi) Co60.
  - Authorized Content in the 10-160B
  - 999TBq (27kCi) Cs137 / 333TBq (9kCi) Co60
  - Dry-load capability
  - Smaller physical payload space





# Disposal Packaging

## Future Disposal Containers

- **435-B Liners**
  - 3 Models (light, medium, heavy)
  - Authorized Content in the 435B pending SAR amendment
  - 999TBq (27kCi) Cs137 (light) / 480TBq (12.9kCi) Co60 (heavy)
  - Dry- and wet-load capability
  - Light has large physical payload space, heavy has smaller
  - In production phase now
- **380-B Liners**
  - 7” of lead shielding
  - Can be used without amendment to SAR
  - 1505TBq (40.7kCi) Cs137 / 285TBq (7.7kCi) Co60
  - Dry-load capability
  - Large physical payload space
  - In design phase now

# Disposal Shipments

- Liners are surveyed for DOT and WAC requirements and loaded into the DOE-owned 10-160B Cask.
- DOE personnel act as Shipper of Record on disposal shipment to a secure DOE facility.

# International Cooperation

- OSRP staff cooperate with IAEA, member states, and other international organizations for repatriation of radioactive sources to the country of origin.
- OSRP staff participate in consultancies or provide training for IAEA source recovery efforts.
- OSRP has recovered sources internationally
- OSRP participates in the Search and Secure Project

# Search and Secure Project (S&S)

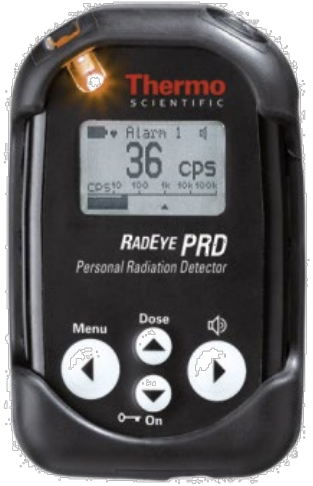
- **S&S launched in 2004 to address the problems of orphaned sources**
- **S&S works with partner countries to establish programs to search, recover, and secure radioactive sources that have fallen out of regulatory control or that have become lost or stolen**
- **Since 2004, the S&S project has**
  - Deployed equipment to over 70 countries
  - Trained over 1,000 people
  - Secured 1,000s of sources
- **Includes Basic, Advanced and Sustainability courses**

*Search for sources in Georgia*

*Abandoned RTG source*

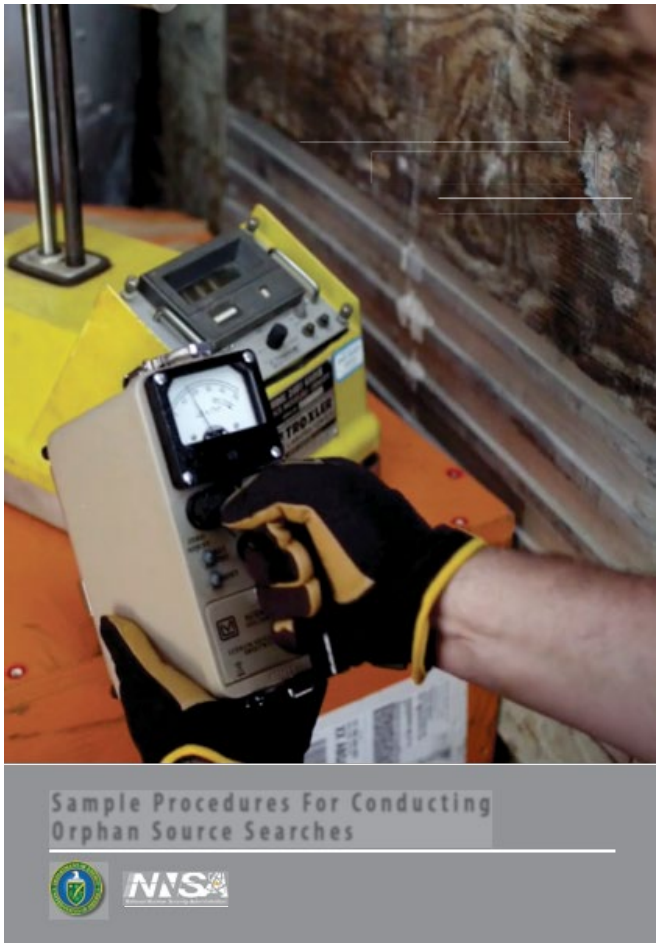
# S&S: Radiation Detection Equipment

- Gives country regulators capability to detect, locate & identify radioactive sources
- Enables regulators to implement regulatory control programs
- Allows many countries to build capabilities  that they could not otherwise develop on their own




# S&S: Program Sustainability

- **Search and Secure provides countries with the resources needed to sustain the program over the long-term, including:**
  - Classroom Training Material Handbook
  - Search and Secure Field Guide and Search Procedures
  - Search and Secure Training Video
  - Access to e-learning tool (RAILS)



# Realistic Adaptive Interactive Learning System (RAILS)

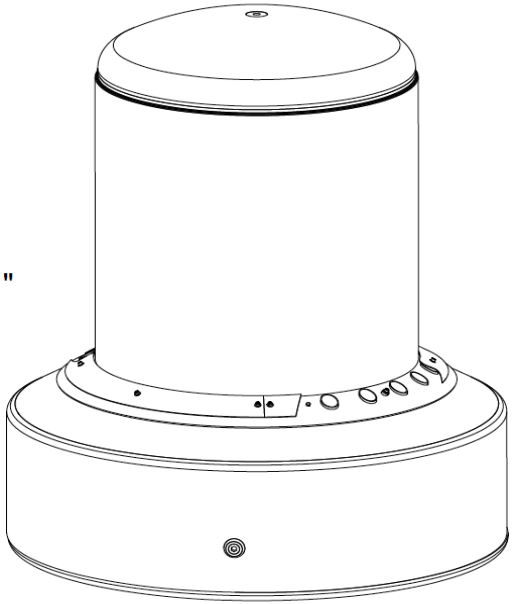
- **RAILS is an e-learning tool that provides users access to educational materials and interactive training simulations. RAILS is customizable and can be adapted to support a country's training needs after the S&S classroom training is complete.**
  - Enables trainers to develop learning paths and track training progress
  - Allows practice with radiation detection instruments in different environments
  - Available in different languages
- **Presented in separate one-day "train the trainer" class**
- **Interactive "video game" format**


# Type B Container Development

- **In 2009, NNSA recognized that, due to new regulations, many commercial Type B container were no long certified for shipments.**
- **This limited the number available Type B containers and increased the costs of Type B shipments while demand was increasing.**
- **In response, NNSA and OSRP began work on two type B containers in 2009.**
  - The 435-B, a smaller, non-shielded over-pack type container
  - The 380-B, a large, shielded over-pack.

# 435-B Design

- **Based on previously certified containers.**
- **Design criteria/parameters**
  - Leak-tight – Normal Condition of Transport (NCT) and Hypothetical Accident Conditions (HAC)
  - Transport by truck, rail, ship, air
  - External dimensions 82” H x 70” Outside Diameter (OD)
  - Internal Cavity 60” H x 43.5” Inside Diameter (ID)
  - Gross weight 10,100 lb (4,581 kg)
  - ~13,000 Ci Co-60, 200 Watts
- **For transportation of**
  - Shielded devices with Cs-137 or Co-60 – max weight 3,505 lb
  - IAEA  Long Term Storage Shield (LTSS) – custom lodgment
  - LTSS Cs, Sr, Ir, Se, Ra, Am, Pu and small neutron sources
  - Disposal liners, pending certification and fabrication

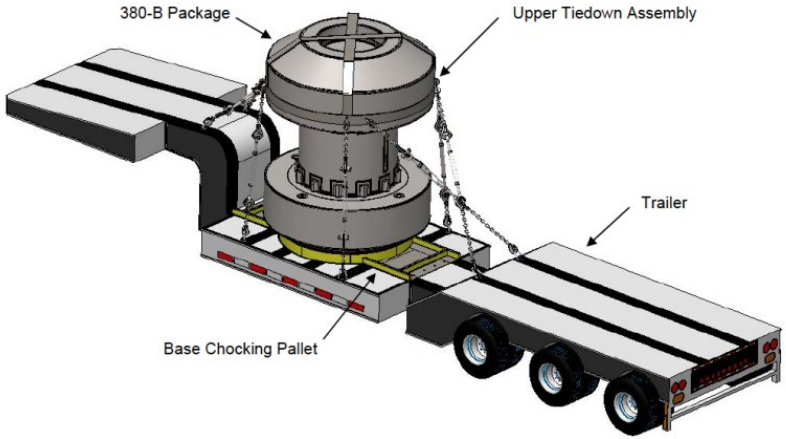


# 435-B Testing

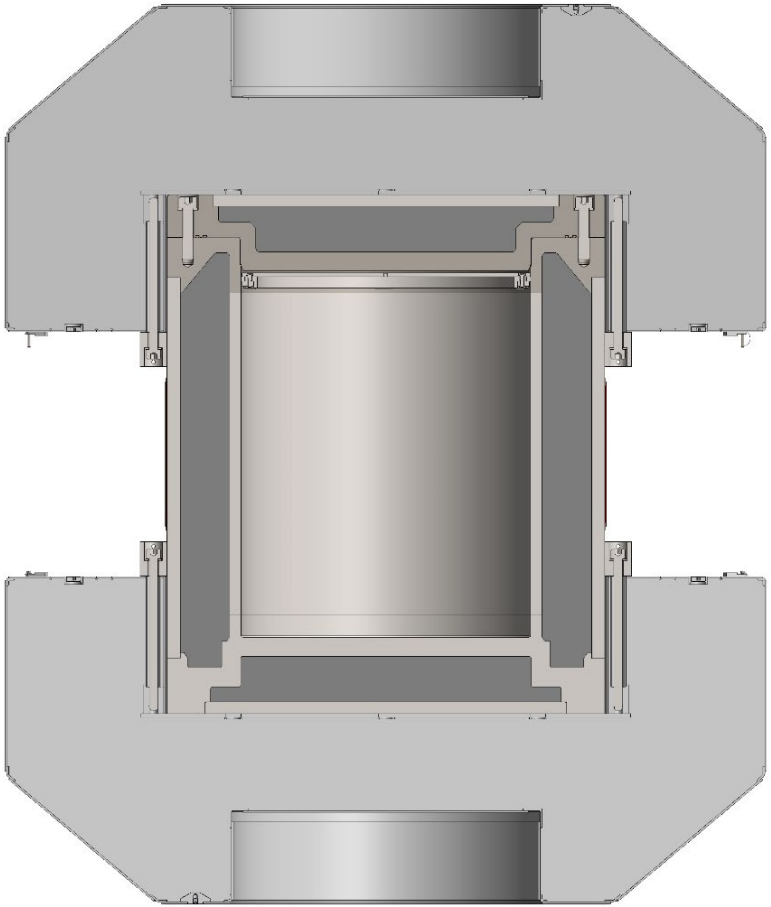
# 435-B First Recovery: March 2018

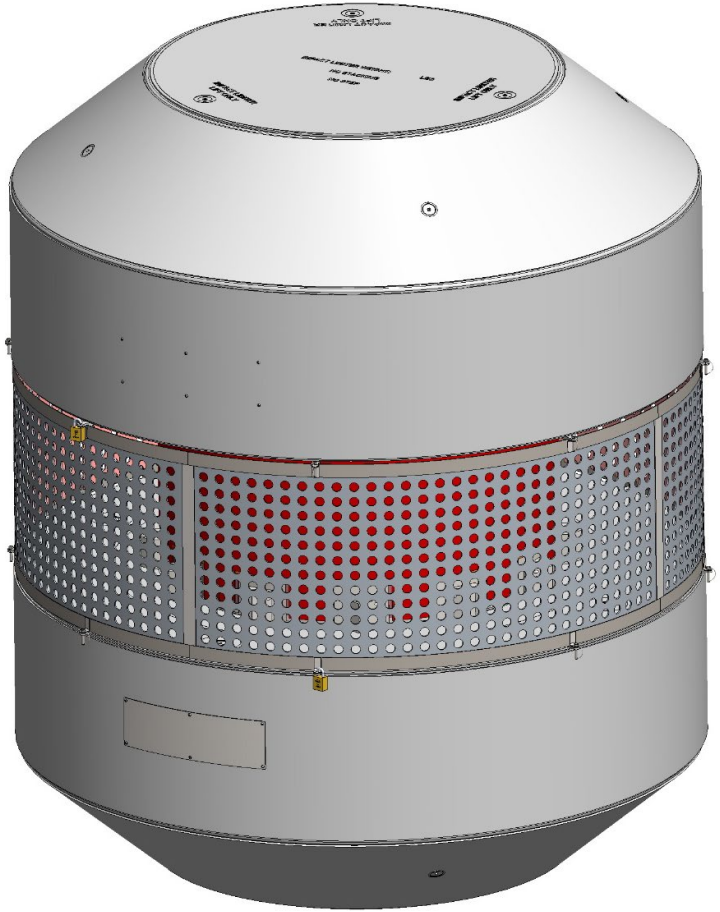
# 380-B Design

- **Shielded transport container for devices that may not be certified for shipment in other containers and/or documentation is not available**
- **Design criteria/parameters:**
  - Leak tight – Normal Condition of Transport (NCT) and Hypothetical Accident Conditions (HAC)
  - Transport on dedicated trailer
  - External dimensions 118” height by 100” OD (including impact limiters)
  - Internal Cavity 48.6” height by 38.0” ID
  - Gross weight 67,000 lb (30,390 kg)
  - Approximately 7,700Ci Co-60
- **Currently in fabrication, scheduled to be completed summer 2019**



# 380-B Design





# Questions?


**Justin Griffin (Team Leader)**
jgriffin@lanl.gov
**505-606-0362**

**Becky Coel-Roback (Program Manager)**
becky_cr@lanl.gov
**505-667-7920**